Petrographic Analysis of Transport Amphorae

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INTRODUCTION

Reported here are the findings of a thin-section study of 56 coarse wares from the rescue excavations at Zeugma.[1] The main aim of this petrographic study is to characterize the sherds and determine the consistency of fabric groups based on field observations made by the Paul Reynolds, and to respond to specific questions asked of the samples by Paul Reynolds. In addition, this analysis will show whether single or multiple clay sources were used, as well as the degree to which raw materials were modified by the potters. Anomalous fabrics (those that appear at odds with the nature of locally available clay) are further considered to attempt to determine their possible provenance. Table 1 lists the sample details. For background information on the samples discussed, the reader is advised to see the chapter "Petrographic Analysis of Table and Kitchen Wares" in this volume, following the chapter by Philip Kenrick, "Pottery Other Than Transport Amphorae."

Lab ref.	Sample ref.	Amphora catalogue	Fabric group	Form
ZG28	2010.7	**AM93**	Fabric 1	Form 12E
ZG29	2012.2	**AM125**	Fabric 1	Form 12B
ZG30	2012.2	**AM125**	Fabric 1	Form 12B
ZG31	2012.3	**AM126**	Fabric 1	Form 12B
ZG32	2039.8	–	Fabric 1	Jar as **PT387**
ZG33	2039.16	**AM155**	Fabric 1-related	Form 3D
ZG34	2011.2	**AM115**	Fabric 1-related	Handle
ZG35	2012.11	**AM123**	Fabric 1-related	Form 9
ZG36	2012.13	**AM118**	Fabric 1-related	Form 3F
ZG37	2012.14	**AM120**	Fabric 1-related	Form 3G
ZG38	2012.20	**AM133**	Coarse Fabric 1	Base 1G
ZG39	2039.11	**AM164**	Coarse Fabric 1	Form 13A variant
ZG40	7003.4	–	Coarse Fabric 1	Combed wavy band on shoulder of jug / flagon
ZG41	2039.25	**AM171**	Fabric 2	Base 1G variant
ZG42	2260.1	**AM219**	Fabric 2	Form 3F
ZG43	2080.16	**AM183**	Fabric 2	Form 3F
ZG44	2086.1	**AM202**	Fabric 2	Form 13D
ZG45	2039.20	**AM158**	PR Fabric 8	Form 10
ZG46	2039.21	**AM161**	PR Fabric 8	Form 11A
ZG47	2080.12	**AM186**	PR Fabric 8	Form 11B
ZG48	2080.13	**AM187**	PR Fabric 8	Form 11
ZG49	2080.14	**AM185**	PR Fabric 8	Form 11A
ZG50	7062.4	–	PR Fabric 8	Painted jug wall
ZG51	2010.6	**AM110**	Fabric 13	Form 14A
ZG52	2080.4	**AM194**	Fabric 13	Form 14B
ZG53	2154.1	–	Fabric 13	Mortarium
ZG54	5034.1	**AM264**	Fabric 13	Form 17A?
ZG55	7026.1	**AM295**	Fabric 13	Small 17A variant
ZG56	7036.1	**AM296 / 303**	Fabric 13	Base 8A / **AM17?**
ZG57	12012.59	–	Fabric 13	Impressed decoration jug
ZG58	7006.14	**AM287**	Local / regional	Base 3
ZG59	7007.2	**AM77**	Coarse Fabric 1	Form 2A
ZG60	15095.4	**AM25**	Fabric 1?	Form 1A

Table 1. Zeugma amphorae and related coarse-ware sherds submitted for fabric analysis (continued on following page).

Lab ref.	Sample ref.	Amphora catalogue	Fabric group	Form
ZG61	15095.9	**AM29**	Fabric 1?	Form 3B
ZG62	15095.11	**AM46**	Fabric 1?	Form 7A
ZG63	2278.1	**AM223**	Gallic?	Gallic amphora?
ZG64	2158.1	**AM217**	Koan	Dressel 2-4
ZG65	2011.1	**AM116**	Guadalquivir?	Dressel 2-4
ZG66	7007.1	**AM88**	South Spanish?	Base 5
ZG68	Tile fragments	**AM455**	–	Base 10 / spatheion
ZG69	12011.44	–	–	–
ZG70	2012.17	**AM143**	LRA 1D	LRA 1
ZG71	7006.13	**AM292**	LRA 1A	Ceramic disc cut from LRA 1
ZG72	7060.8	**AM327**	LRA 1A(sample 1)	LRA 1
ZG73	7060.8	**AM327**	LRA 1A (sample 2)	LRA 1
ZG74	7060.9	**AM328**	LRA 1B	LRA 1
ZG75	12002.13	**AM374**	LRA 1	LRA 1
ZG76	12011.24	**AM463**	LRA 1E	LRA 1
ZG77	12011.25	**AM464**	LRA 1F	LRA 1
ZG78	12011.26	**AM465**	LRA 1G	LRA 1
ZG79	12011.41	**AM480**	LRA 1	LRA 1
ZG80	12011.52	**AM462**	LRA 1	LRA 1
ZG81	12012.9	**AM549**	LRA 1	LRA 1
ZG82	12012.10	**AM550**	LRA 1	Ceramic disc cut from LRA 1
ZG83	12012.12	**AM551**	LRA 1	LRA 1
ZG27	Euphrates sand	–	Reference only	–

Table 1. Zeugma amphorae and related coarse-ware sherds submitted for fabric analysis (continued).

RESULTS

This program of petrographic analysis addresses several queries relating to fabric groups for Zeugma amphorae, these groups having been established in the field by the pottery specialist. Accordingly, the findings of this analysis are presented here as replies to those specific questions.

Fabric 1

This is a red-brown firing fabric that is sand-rich and has a large number of inclusion types. This indicates a derivation from a relatively complex geology and is entirely consistent with Zeugma.[2] Inclusions are moderately well sorted and angular to subangular (though softer lithologies are better rounded). These inclusions represent natural sand; none of the members of this fabric group is tempered. However, the two 2012.2 sherds (ZG29 and ZG30: **AM125**), although related to Fabric 1, should be considered a different fabric or subfabric. These have a relatively low inclusion concentration (<10%), which is also finer-grained.

Question: How consistent is Fabric 1? **Response:** A significant amount of variation exists in Fabric 1. Some of this may be explained by the use of clays at increasing distance from the main alluvial channel, where it would be expected that differing contents of sand, carbonate, organic matter, etc., would give rise to clays of subtly differing forming, drying, and firing properties. Two separate fabrics are proposed here:

- Type Fabric 1: comprising 2010.7 (**AM93**) and 2039.8 (jar, **PT387**)
- Fine Fabric 1: comprising 2012.2 (ZG29 and ZG30: **AM125**)

Sherd 2012.3 (**AM126**) is intermediate between these two, showing similarities with both although with closer affinities to the type Fabric 1.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG28	2010.7	**AM93**	Fabric 1	Fabric 1
ZG29	2012.2	**AM125**	Fabric 1	Fine Fabric 1
ZG30	2012.2	**AM125**	Fabric 1	Fine Fabric 1
ZG31	2012.3	**AM126**	Fabric 1	Fabric 1
ZG32	2039.8	As **PT387**	Fabric 1	Fabric 1

Table 2. Fabric 1 members.

Fabric 1–Related

These are similar to Fabric 1 in terms of their inclusion types, morphologies, frequencies, and the clay properties, minor differences being mainly gradational. The one exception here is 2012.11 (**AM123**).

Question: Is 2039.16 (**AM155**: Form 3D) a compact version of this fabric or something different? **Response:** This is very similar to the type Fabric 1, from which it differs only

by having fewer inclusions (though of the same type) and a very fine clay matrix (with no conspicuous silt content or mica). This is a Fabric 1 variant or subfabric.

Question: Where do 2011.2 (**AM115**), 2012.11 (**AM123**), 2012.13 (**AM118**), and 2012.14 (**AM120**) fit in? **Response:** 2011.2 (ZG34: **AM115**) is the same as Fine Fabric 1. 2012.13 (ZG36: **AM118**) is a high-fired fabric as indicated by the complete composition of primary carbonate grains, but otherwise it remains essentially Fabric 1. Sherd 2012.14 (ZG37: **AM120**) is also Fabric 1 (coarse) but shows a relatively narrow range of inclusion sizes and a paucity of very fine-grained material (silt). In the latter respect it is very similar to 2039.16 (ZG33, **AM155**: Form 3D).

Question: Is 2012.11 (ZG35: **AM123**) (Form 9) a separate fabric? **Response:** Yes, this is a new fabric and is characterized by a very calcareous matrix, very few siliclastics (i.e., "quartz sand"), being dominated by carbonate inclusions and a significant proportion of highly weathered basic / ultrabasic material (i.e., gabbro and basalt, including serpentine). The carbonate grains typically show a very irregular morphology and are fine-grained (micritic) but occasionally with coarser calcite (polyphase microsparite) developed in cavities. These features identify this material as a mixture of mainly soil carbonate (caliche) and lesser inclusions derived from outcrops of micritic limestone. Significantly the calcareous matrix does not contain microfossils (foraminifera). This fabric is made of clay that is clearly distant from a major river channel (i.e., the Euphrates) as it lacks a quartz-dominated sand. It is unlikely that this is simply edge-of-Euphrates-floodplain material as this would account for the calcareous matrix but not the inclusions, which are significantly different from those represented by the Birecik sand.[3] It is more likely that this clay is from a wadi eroding a limestone formation with basic and (lesser) intermediate igneous intrusions in the immediate catchment.

Question: Is 2012.2 (**AM125**) close to the Syrian group (i.e., Fabrics 13 and amphora Fabric 8)? **Response:** This is different from Syrian amphora Fabric 8 but shows a few similarities with Syrian Fabric 13, notably the very carbonate-rich matrix. For example, there are general matrix similarities with 2080.4 (**AM194**) and 5034.1 (**AM264**), although the inclusion types are different. Despite this, it is concluded that 2012.11 (**AM123**) is not of the Syrian group because it differs in one fundamental way. In addition to being highly calcareous (particularly Fabric 13) the Syrian fabrics also contain abundant microfossils (Foraminifera). Their presence indicates the use of a marine or brackish water clay and not a freshwater clay associated with a large river system such as the Euphrates. Although Fabric 1 and other local fabrics do contain very occasional Foraminifera, these can be shown to have been derived from the reworking or Quaternary or Tertiary marls and limestones, as evidenced by the typical recrystalization the microfossil cavities.

A much better match is seen between 2012.11 (**AM123**) and Coarse Fabric 1, 7003.4 (not catalogued: shoulder with combed wavy lines, probably a flagon, not amphora).

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG33	2039.16	**AM155**	Fabric 1-related	Coarse Fabric 1
ZG34	2011.2	**AM115**	Fabric 1-related	Fine Fabric 1
ZG35	2012.11	**AM123**	Fabric 1-related	New fabric
ZG36	2012.13	**AM118**	Fabric 1-related	Coarse Fabric 1
ZG37	2012.14	**AM120**	Fabric 1-related	Coarse Fabric 1

Table 3. Fabric 1–Related members.

Coarse Fabric

This fabric comprises three members, although even to the naked eye these three immediately show some obvious differences:

- 2012.20, **AM133,** the finest member; essentially the same as Fabric 1.
- 2039.11, **AM164,** coarser than 2012.20 (**AM133**), but again essentially type 1; contains garnet (single observation).
- 7003.4, not catalogued (combed wavy band); With a relatively high content of serpentinite / altered basalt this sherd is more similar to 2012.11 (**AM123**) and should be considered a different fabric.

It is suggested that this coarse fabric be discontinued, as 2012.20 (**AM133**) is no more coarse than Fabric 1, and 7003.4 is compositionally distinct, leaving 2039.11 (**AM164**) as the only member.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG38	2012.20	**AM133**	Coarse Fabric	Fine Fabric 1
ZG39	2039.11	**AM164**	Coarse Fabric	Coarse Fabric 1
ZG40	7003.4	Not catalogued: combed wavy band	Coarse Fabric	New Fabric: same as ZG35

Table 4. Coarse fabric members.

Fabric 2

Question: How uniform is Fabric 2? **Response:** The visual (textural) similarity evident to the naked eye is not maintained at thin-section level. Instead this fabric group exhibits a fair amount of compositional variation.

Question: Fabric 2 is considered to be the same as Fabric 1 but with more lime. Is this correct? **Response:** This presumably refers to lime inclusions rather than fine-grained lime in the clay body. An increase of the latter would result in a paler fired color whereas Fabric 2 members fire to the same reddish-orange color as Fabric 1.

In fact only two members of this fabric (2039.25 / **AM171** and 2080.16 / **AM183**) have more lime inclusions, the other two (2260.1 / **AM219** and 2086.1 / **AM202**) being essentially the same as Fabric 1.

However, there is a significant difference between these two lime-rich fabrics. Sherd 2039.25 (**AM171**) could be taken as the type Fabric 2 example, although there still is not a great difference from Fabric 1. Sherd 2080.16 (**AM183**) is significantly different, being both much more carbonate rich, and having dacite, psammite, and schistose material as the main inclusion types.

Question: Does local amphora 2086.1 (**AM202**: Form 13D) belong, or is it Fabric 1? **Response: AM202** is Fabric 1.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG41	2039.25	**AM171**	Fabric 2	Fabric 2: abundant carbonate
ZG42	2260.1	**AM219**	Fabric 2	Fabric 1
ZG43	2080.16	**AM183**	Fabric 2	Separate fabric: dacite and schist with abundant carbonate
ZG44	2086.1	**AM202**	Fabric 2	Fabric 1

Table 5. Fabric 2 members.

Amphora Fabric 8

This is considered to be a separate, very coarse painted group, differing from the Fabric 13 Syrian group, although similarly based on a Foraminera-bearing calcareous clay. The clay matrix of Fabric 8 is more iron-rich than Fabric 13, typically developing a pale orange color on firing in contrast to the greenish hue of the latter. The inclusions also differ from Fabric 13, notably having more iron-rich material (weathered basalt), and minor amounts of arkose and tuff.

Question: Is it very coarse? **Response:** No, unless coarse is used to describe the ferruginous inclusions (above). 2039.21 (**AM161**) and 2080.13 (**AM187**) have conspicuous ferruginous material, seen to a lesser extent in 7062.4 (painted-jug fragment). 2080.14 (**AM185**) is a reduced piece with a lower overall siliclastic component and correspondingly a noticeable development of subparallel shrinkage voids.

Question: 2039.20 / **AM158** is the type piece — how similar are the other proposed members? **Response:** The others are essentially the same except for 2039.21 (**AM161**) and 7062.4 (painted-jug fragment). 2039.21 (**AM161**) should be considered as a subfabric, being similar to the type Fabric 8 except in having rounded lateritic grains. 7062.4 also has rounded lateritic grains, but here the calcareous matrix lacks foraminifera and has abundant schistose / tectonized inclusions. Fabric 8 members and 7062.4 (painted jug) are sufficiently different to be considered different fabrics, but are related through subfabric 2039.21 (**AM161**):

- 2039.20, **AM158,** standard Fabric 8 — limestone-rich matrix with chert / quartzite / basalt sand.
- 2039.21, **AM161,** different fabric: has rounded ferruginous / lateritic clast (absent from 2039.20 / **AM158**).
- 2080.12, **AM186,** standard Fabric 8 — same as 2039.20 (**AM158**).
- 2080.13, **AM187,** similar to 2039.21 / **AM161** but has less fines in matrix.
- 2080.14, **AM185,** Fabric 8, as 2039 and 2080.12.
- 7062.4, painted-jug fragment, distinct fabric, characterized by rounded ferruginous / lateritic grains, a high proportion of tectonized material, and a very calcareous matrix.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG45	2039.20	**AM158**	PR Fabric 8	Fabric 8
ZG46	2039.21	**AM161**	PR Fabric 8	Fabric 8: lateritic subfabric
ZG47	2080.12	**AM186**	PR Fabric 8	Fabric 8
ZG48	2080.13	**AM187**	PR Fabric 8	Fabric 8
ZG49	2080.14	**AM185**	PR Fabric 8	Fabric 8
ZG50	7062.4	Painted jug fragment	PR Fabric 8	Separate fabric: tectonized

Table 6. Amphora Fabric 8 members.

Fabric 13: Syrian Painted

The immediate visual impression is that these members do belong to the same fabric group. There is a general consistency of color (allowing for differences expected from different firings), the grain size is reasonably uniform, and all members are flecked through with reddish inclusions that represent the iron-rich alteration products of basic igneous rocks.

This fabric group is easily distinguished from local Zeugma fabrics by having a highly calcareous matrix, rich in foraminifera. There are also significant differences in inclusion types. Fabric 13 has a notable paucity or absence of granite, trachytic basalt, and serpentine compared with the local Zeugma fabrics.

Question: How consistent is the group? **Response:** The table shows that that all but two are considered to be of the same Fabric (13). Of the outsiders, 7026.1 (**AM295**) has a very high carbonate content (matrix) and a low siliclastic content. The latter includes schistose / tectonized material. 7036.1 (**AM296 / 303**) has abundant granodiorite and a very high concentration of carbonates.

Question: Is 2080.4 (**AM194**) a coarse version of this fabric? **Response:** No, although lateritic material (derived from basalt weathering) is more conspicuous in this fabric. The impressed-decoration jug 12012.59 (as **PT491**) is confirmed as belonging to Fabric 13.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised Fabric group	Form
ZG51	2010.6	**AM110**	Fabric 13	Fabric 13	Form 14
ZG52	2080.4	**AM194**	Fabric 13	Fabric 13	–
ZG53	2154.1	–	Fabric 13	Fabric 13: coarser variety	Mortarium
ZG54	5034.1	**AM264**	Fabric 13	Fabric 13	–
ZG55	7026.1	**AM295**	Fabric 13	Separate fabric: schistose	–
ZG56	7036.1	**AM296/ AM303**	Fabric 13	Separate fabric: granodioritic	–
ZG57	12012.59	–	Fabric 13	Fabric 13	Small jug with impressed decoration, as **PT491**

Table 7. Fabric 13 members (amphorae and other forms).

Sample	Context	Catalogue	Form
Amphorae			
ZG54	5034.1	**AM264**	Large Form 17A? / Base 8A
ZG56	7036.1 / 7065.15	**AM296 / 303**	Large Form 17A / Base 8A
–	7060.3	**AM304**	Large Form 17A? (shoulder)
–	12012.32	**AM529**	Small Form 19
–	12011.77	**AM422**	Small Form 19
–	7005.1	**AM278**	Small Form 19 or small Form 17A
Plain forms			
–	7060.38	–	Jug
ZG53	–	–	Mortarium
ZG57	12012.59	–	Jug with impressed decoration as **PT491**

Table 8. Samples used for reassessment of Fabric 13 amphorae and plain wares.

Following the initial study of all amphora fabrics presented in this report, I made a reassessment of Fabric 13 amphorae and plain wares (e.g., mortars) based on a larger number of samples. These included a greater cross section of the range of Syrian painted-amphora variants. The aim was to establish whether it was possible to distinguish fabric subgroups and associated typological variants within the data set and hence identify distinct production centers or workshops within the Syrian plain and amphora series.

The sample chosen for analysis comprised the following:

Sample	Context	Catalogue	Form
Amphorae			
ZG51	2010.6	**AM110**	Large Form 14A
–	7060.2	**AM300**	Large Form 14A
ZG52	2080.4	**AM194**	Large Form 14B
–	7003.2	**AM266**	Large Form 14B
–	7026.2	**AM294**	Small Form 15A
–	7064.1	**AM338**	Large Form 15A
–	7306.1	**AM254**	Large / Medium Form 15B
–	12011.59	**AM389**	Large Form 15C
–	12012.20	**AM503**	Large Form 15C
–	12012.19	**AM504**	Large Form 15C (or Form 17A)
–	7006.7	**AM282**	Large Form 16A
–	7004.1	**AM270**	Large Form 16A
–	12011.55	**AM390**	Large Form 16B
–	7003.1 / 7004.2	**AM271**	Small Form 17D
–	7065.4	**AM346**	Small Form 17F
ZG55	7026.1	**AM295**	Small Form 17A variant

Fabric 13 is a relatively uniform fabric group in which apparent differences are mainly due to slight variations in inclusion proportions, with textures also modified in some cases by high firing (e.g., color development, loss of carbonate inclusions, "granularity," etc.) There is no systematic correlation between fabric elements and amphora subgroups.

Main Points

1) Overall this fabric group does exhibit some variation, but with one or two exceptions, there are few fundamental differences in composition. What we see are varying proportions of a relatively consistent suite of rock and mineral inclusions, combined with gradations in mean inclusion size.

2) Given the above, there are no criteria that can be used to further subdivide Fabric 13 into subfabrics, again with a few exceptions. Most fabrics share a large proportion of a common set of inclusion types, i.e.: chert, monocrystalline quartz, polycrystalline quartz (mosaic), polycrystalline quartz (preferred orientation), vein quartz, quartz-epidote, orthoclase, plagioclase, granite, granodiorite, myrmekite, rhyolite, dacite, andesite, acid igneous groundmass, trachyte: (undifferentiated) basalt, (undifferentiated) basaltic glass, olivine basalt, weathered basalt, ferruginous alteration (basalt-derived laterite), volcanic ash, clinopyroxene, serpentine, hornblende, colorless magnesian amphibole, fibrous brown amphibole, muscovite biotite, biotite / muscovite schist sandstone, and chlorite (phyllite).

It is possible to indicate those fabrics in which, say, basalt or acid igneous inclusions predominate but in practice it is very unreliable to further subdivide in this way. Overall the similarity in inclusion types indicate that most of the Fabric 13 members are made from clay from the same alluvial system, and are entirely consistent with a Euphrates provenance or from neighboring drainage.

Variations in grain size and inclusion: Clay ratios are again conspicuous but do not provide a workable basis on which to construct subfabrics. It must be remembered that such differences, although conspicuous, can merely reflect natural variation occurring within the clay deposit over short stratigraphic and lateral distances. This is particularly the case in an alluvial system such as the Euphrates, which floods seasonally, and whose successive terraces will vary compositionally and texturally. Different production centers are not suggested by the variation of inclusion sizes and proportions seen in the majority of Fabric 13 members.

3) The second defining characteristic of this fabric is the calcareous nature. This has two components, the calcareous clay matrix and discrete inclusions. Both components have the same source, namely the Tertiary limestone formations which outcrop extensively in northern Syria and locally in southern Turkey (including in the immediate hinterland of Zeugma).

Fabric 13 sherds therefore have a suite of noncalcareous inclusions derived from the erosion of mainly igneous and metamorphic rocks by Turkey headwaters, and a calcareous matrix and inclusion set derived from erosion on the limestone formations in the middle course of the Euphrates and tributaries. As expected, the limestone component increases south of Zeugma where Tertiary limestones outcrop extensively. By contrast, the local Zeugma fabrics have a much lower carbonate content (both as inclusions and fine-grained matrix) as indicated by their overall more reddish color when fully oxidized.

The proportion and grain size of the calcareous inclusion in Fabric 13 are seen to vary significantly, but again differences are gradational. These inclusions are mainly of fine-grained limestone (micrite) and microfossils (foraminifera) but there is also some soil carbonate (caliche). Where inclusions are very abundant the fabric has what has been described as a granular appearance. Where these carbonate inclusions are smaller, less abundant, or, importantly, have been largely lost through firing, the matrix appears to be made from a more plastic clay.

4) Despite this relative uniformity of the Fabric 13 sherds, there a small number that show sufficient differences to perhaps warrant subfabric status. These are:

- 7003.2 / **AM266** (Large Form 14B) and 7060.3 / **AM304** (Large Form 17A?): These both lack the typical high concentration of limestone inclusion and / or calcareous matrix of typical Fabric 13 sherds. Of the two, 7003.2 / **AM266** is more calcareous, but here limestone inclusions are sparse and there are very few foraminifera. 7060.3 / **AM304** has a much lower carbonate content, as indicated by the reddish fired color. Both sherds are further distinguished by having a high concentration of very fine silt and by containing volcanic ash (and having a correspondingly high frequency of acid / intermediate igneous inclusions). Overall these features suggest a more northerly origin than for typical Fabric 13 sherds.
- 7060.38 (not Fabric 13?): Again lacking the distinctive carbonate signature of Fabric 13. This could be related to the above subfabric but lacks conspicuous volcanic ash. Again a source north of Syria is suggested.

5) Given the continuous variation in Fabric 13, it is not possible to uniquely match either Fabric 6 or the Fabric 8 fine-ware example with any specific Fabric 13 amphora subgroup. The best matches appear to be Fabric 6 with 12012.19 / **AM504** (Form 15C or Form 17A) and Fabric 8 with 7065.4 / **AM346** (Small Form 17F).

Early Roman

Question: How consistent is this group? **Response:** All members reflect the local Euphrates sediment characteristics, i.e., moderately lime-rich clays that lack foraminifera (except derived material). The inclusions show good agreement with those in the reference sand sampled at Birecik. Differences exist but are gradational, being mainly variations in the proportions and sizes of a consistent set of inclusions.

Petrographic analysis suggests three separate fabrics / subfabrics.

7006.14	**AM287**	Characterized by very abundant fine sand: micaceous
7007.2	**AM77**	A different fabric from 7006.14 (**AM287**). Fine sand is absent, clasts are few and typically much larger. Grain types are essentially the same as for 7006.14 (**AM287**) but mica is rare
15095.4	**AM25**	Same fabric as 7007.2 (**AM77**), slightly more chert
15095.9	**AM29**	Similar to 7007.2 (**AM77**) and 15095.4 (**AM25**) but with lower total inclusion content
15095.11	**AM46**	Similar to 15095.4 (**AM25**), 15095.9 (**AM29**), and 15095.11 (**AM46**) but higher fired: slightly more fine sand

Question: Are any related to Fabric 1? **Response:** Yes (see table 9).

Question: Are any related to Syrian fabrics? **Response:** No, these are all local fabrics.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG58	7006.14	**AM287**	Early Roman: local/regional	Micaceous
ZG59	7007.2	**AM77**	Early Roman: Coarse Fabric 1	As Fabric 1
ZG60	15095.4	**AM25**	Early Roman: local / regional	As Fabric 1
ZG61	15095.9	**AM29**	Early Roman: local / regional	As Fine Fabric 1
ZG62	15095.11	**AM46**	Early Roman: local / regional	As Fine Fabric 1

Table 9. Early Roman fabrics.

Long-Distance Imports

These represent a range of proposed long-distance imports at Zeugma that have been tentatively identified by the pottery specialist. A comparison is made here with the corresponding published descriptions (Peacock and Williams 1986) in order to verify provenance by direct fabric analysis.

Lab ref.	I.D.	Catalogue	Initial fabric group	Revised fabric group
ZG63	2278.1	**AM223**	Gallic amphora?	Yes: similar to Class 27 fabric
ZG64	2158.1	**AM217**	Dressel 2-4	Possible: similar to Class 3 / 10 Campanian fabric
ZG65	2011.1	**AM116**	Dressel 2-4 Guadalquivir?	Yes: good match with Class25 / Dressel 20
ZG66	7007.1	**AM88**	Spanish amphora base?	Matches local Euphrates clay
ZG68	–	–	Tile fragments	Matches local Euphrates clay
ZG69	12011.44	**AM455**	Hollow spatheion base	Not matched: some similarities to Euphrates clay

Table 10. Long-distance imports.

Question: 2278.1 (ZG63: **AM223**) Is this a Gallic amphora? **Response:** A very micaceous silty fabric with a low lime content. Inclusions are natural and fine grained (mean 0.1 mm) and include clinopyroxene, monocrystalline quartz, sheared quartz-mica composite grains ("schist"), micrite, muscovite, psammite, soil carbonate (abundant), and vein quartz (often iron-stained). Basic igneous material is absent. Micas commonly show micro-kinking, confirming their metamorphic origin. This is similar to the micaceous fabric described for Class 27 (inc. Pelichet 47, Gauloise 4) although it is not clear from the published description how much metamorphic material this type fabric permits.

2158.1 (ZG64: **AM217**)
Dressel 2–4 handle

A red-firing fabric with a low lime content. Inclusions are natural (i.e., not temper), and have a mean grain size of 0.3 mm. These include aegerine-augite (single), chert, augite, plagioclase, polycrystalline quartz, potassium feldspar, and soil / secondary carbonate. This fabric is clearly derived from a basic igneous rock (basalt-trachyte) and appears similar to the published Class 3 / 10 Campanian fabric or equivalent.

2011.1 (ZG65: **AM116**)
Dressel 2–4 coarse fabric: Guadalquivir?

A noncalcareous fabric derived from an acid to intermediate igneous parent. Inclusions are coarse (mean 1 mm), are well rounded, and represent added temper. These are mainly quartz, orthoclase, rhyolitic groundmass, microgranite, and quartz-hornblende composites (granodiorite). Limestone and basic igneous lithologies are absent (rare augite), and metamorphics are represented by rare psammites and quartz-mica selvages. This fabric does show much similarity with the Guadalquivir fabric published for Class 25 / Dressel 20, although the latter is very general.

7007.1 (ZG66: **AM88**)
Spanish amphora base?

A red-buff firing fabric with a wide range of abundant inclusions. These are natural, have a mean grain size of 0.5 mm, and include basalt, biosparite, clinopyroxene (augite), epidote, ferruginous alteration (basalt-derived), monocrystalline quartz, muscovite, plagioclase, polycrystalline quartz, serpentine, sheared quartz-mica selvages, surface / soil carbonate, trachytic basalt, and vein quartz. It is not possible to match this with a published Spanish fabric, but this mineral assemblage is essentially that shown by the local Fabric 1.

ZG68 Tile fragments
A calcareous fabric tempered with medium sand (mean 0.5 mm) comprising basalt, chert, clinopyroxene, dacite, foraminera, granite, granodiorite, micrite, monocrystalline quartz, plagioclase, rhyolite, serpentine (trace), trachytic basalt, and vein quartz. These inclusions are those found in the Euphrates sediment at Zeugma.

12011.44 / **AM455** (ZG69)
Hollow spatheion base

A buff-red firing fabric with a relatively high concentration of ferromagnesian minerals and carbonates. This is a high-fired fabric in which primary carbonate grains have undergone thermal decomposition. Inclusions have a mean grain size of 0.4 mm and include basalt, chert, colorless amphibole, clinopyroxene, foraminera, granite, granodiorite, hornblende, micrite, orthoclase, polycrystalline quartz, serpentine, sheared quartz, and vein quartz. Again there is much overlap here with the Euphrates inclusions, although the amount of basic igneous material is low.

LRA 1 Fabrics

Fourteen undifferentiated LRA 1 fabrics were analyzed. These are described in the following section and suggestions of possible groupings are made.

Lab ref.	I.D.	Catalogue	Fabric group
ZG70	2012.17	**AM143**	LRA 1
ZG71	7006.13	**AM292**	LRA 1
ZG72	7060.8	**AM327**	LRA 1
ZG73	7060.8	**AM327**	LRA 1
ZG74	7060.9	**AM328**	LRA 1
ZG75	12002.13	**AM374**	LRA 1
ZG76	12011.24	**AM463**	LRA 1
ZG77	12011.25	**AM464**	LRA 1
ZG78	12011.26	**AM465**	LRA 1
ZG79	12011.41	**AM480**	LRA 1
ZG80	12011.52	**AM462**	LRA 1
ZG81	12012.9	**AM549**	LRA 1
ZG82	12012.10	**AM550**	LRA 1
ZG83	12012.12	**AM551**	LRA 1

Table 11. LRA 1 fabrics.

2012.17 / **AM143**: A calcareous pale-green (high-fired) fabric that has lost much of its primary carbonate. Inclusions (mean grain size = 0.3 mm) are abundant and are predominantly limestone but also include chert, clinopyroxene, hornblende, limestone, monocrystalline quartz, plagioclase, sheared quartz +/ selvages, vein quartz.

7006.13 / **AM292**: Buff-red fired fabric characterized by a very high silt content. Inclusions (mean grain size = 0.4 mm) comprise biosparite, chert, colorless (Mg) amphibole, clinopyroxene, ferruginous alteration, micrite, plagioclase, serpentine, sheared quartz +/ selvages, and soil / secondary carbonate. All carbonate appears micritic due to thermal decomposition.

7060.8 / **AM327**: Buff-firing calcareous fabric with a relatively high fine sand content. Inclusions (mean grain size = 0.4 mm) are predominantly limestone (thermally decomposed) including foraminifera, basalt, chert, colorless amphibole, clinopyroxene, ferruginous alteration, hornblende (rare), monocrystalline quartz, and orthoclase.

7060.8 / **AM327**: Buff-firing calcareous fabric with biosparite limestone fragments, basalt (rare), chert, chromite (rare), colorless amphibole, clinopyroxene (rare), granodiorite, hornblende, monocrystalline quartz, orthoclase, and soil carbonate. The mean grain size is 0.3 mm.

7060.9 / **AM328**: Buff-orange fabric with a low inclusion content without conspicuous carbonate. Basalt-derived grains dominate, the full assemblage comprising basalt (>90%), chert (rare), clinopyroxene, ferruginous alteration, monocrystalline quartz (rare), plagioclase, serpentine (rare). The mean grain size is 0.5 mm.

12002.13 / **AM374**: A high-fired greenish calcareous fabric. Inclusions (mean 0.3 mm) are dominated by carbonate (now thermally decomposed) with basalt, chert (rare), colorless amphibole, clinopyroxene, ferruginous alteration, hornblende, monocrystalline quartz, orthoclase, plagioclase, polycrystalline quartz, serpentine (after clinopyroxene), surface carbonate, vein quartz.

12011.24 / **AM463**: An orange-red noncalcareous fabric dominated by basalt-derived inclusions (mean 0.5 mm). These comprise basalt (>95%), clinopyroxene, epidote, ferruginous alteration, granite (rare), monocrystalline quartz (rare), orthoclase (rare), plagioclase, serpentine (after clinopyroxene), and weathered basalt.

12011.25 / **AM464**: A red-orange fabric characterized by a high proportion of carbonate grains (mean 0.2 mm), most of which are thermally decomposed. Other inclusions are chert, colorless amphibole, clinopyroxene, monocrystalline quartz, plagioclase, and secondary / soil carbonate.

12011.26 / **AM465**: An orange fabric in which the apparent color density is diluted by a very high fine sand content. Inclusions (mean 0.5 mm) comprise andesite, chert, clinopyroxene, ferruginous alteration, granite, granodiorite, hornblende, micrite, monocrystalline quartz, orthoclase, plagioclase, soil carbonate, and weathered basalt.

12011.41 / **AM480**: Very similar to 12011.26 / **AM465** but slightly coarser (mean 0.6m) and having a lower total inclusion content. Irregular pores are common, suggesting shrinkage of an overwet paste. These are now lined with secondary carbonate. Inclusions are biotite, chert, clinopyroxene, dacite, epidote, foraminifera, hornblende, micrite, plagioclase, polycrystalline quartz mosaic, rhyolite, sheared quartz +/ selvages, and weathered basalt.

12011.52 / **AM462**: A light orange high-fired fabric, again with color dilution due to a very high inclusion content. Inclusions (0.5 mm) comprise chert, chlorite, colorless amphibole, clinopyroxene, hornblende, micrite, monocrystalline quartz, orthoclase, serpentine, surface carbonate, vein quartz (iron-stained), and weathered basalt.

12012.9 / **AM549**: An orange-red fabric with a very high inclusion content and characterized by abundant bio-

sparite limestone (with minimal thermal decomposition). Inclusions comprise clinopyroxene, epidote, ferruginous alteration, garnet, micrite, monocrystalline quartz, muscovite, orthoclase, plagioclase (zoned euhedra), and sheared quartz +/ selvages.

12012.10 / **AM550**: A pale green high-fired calcareous fabric showing extensive loss of primary carbonate due to firing. Inclusions (mean 0.5 mm) are not abundant and include basalt (rare), clinopyroxene (rare), dacite, granite (graphic variety, single observation), hornblende, micrite, orthoclase, plagioclase, polycrystalline quartz mosaic, and serpentine (rare).

12012.12 / AM551: A greenish-brown high-fired calcareous fabric with a high concentration of natural fine sand. Inclusions (mean 0.5 mm) include basalt (rare), chert, clinopyroxene, granite (graphic type, single observation), micrite, monocrystalline quartz, and sheared quartz +/ selvages.

Possible Groups

Ten of the fourteen LRA samples make up four fabric groups. These are:

1. 2012.17 (**AM143**) and 12002.13 (**AM374**)
2. 7060.9 (**AM328**) and 12011.24 (**AM463**)
3. 7006.13 (**AM292**) and 7060.8 (**AM327**, both samples)
4. 12011.25 (**AM464**), 12011.41 (**AM480**), and 12012.9 (**AM549**)

Fabric Summaries

2010.7 (ZG28: **AM93**)

Carbonates = 40% wt. Siliclastics = 60% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.25 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: basalt, biosparite, biotite, chert, clinopyroxene, diorite, epidote, ferruginous alteration, foraminifera, garnet, granite, hornblende, micrite, monocrystalline quartz, muscovite, orthoclase, plagioclase, serpentine, sheared quartz ± selvages, weathered basalt.

2012.2 (ZG29: **AM125**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.2 mm. Inclusions matrix (high / medium / low) = L. Temper: no. Inclusions: basalt, chert, colorless amphibole, clinopyroxene, ferruginous alteration, foraminifera hornblende, micrite, monocrystalline quartz, orthoclase, plagioclase, serpentine (rare), trachyte (undifferentiated), weathered basalt.

2012.2 (ZG30: **AM125**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.15 mm. Inclusions matrix (high / medium / low) = M. Temper" no. Inclusions chert, clinopyroxene, ferruginous alteration, hornblende, micrite, muscovite, plagioclase, serpentine (rare), trachyte (undifferentiated), weathered basalt.

2012.3 (ZG31: **AM126**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.25 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: acid igneous groundmass, basalt, chert, clinopyroxene, epidote, granite, hornblende, micrite, monocrystalline quartz, muscovite, orthoclase, plagioclase, polycrystalline quartz, sheared quartz +/ selvages, trachyte (undifferentiated), serpentine (rare).

2039.9 (ZG32: jar, as **PT387**)

Carbonates = 40% wt. Siliclastics = 60% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.25 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: acid igneous groundmass, basalt, biotite, chert, clinopyroxene, diorite, epidote, granite, hornblende, monocrystalline quartz, muscovite, plagioclase, sheared quartz +/ -selvages, trachyte (undifferentiated).

2039.16 (ZG33: **AM155**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = M. Temper: possible (bimodal). Inclusions: basalt, colorless amphibole, clinopyroxene, crystal tuff (single, rhyolitic), dacite, micrite, polycrystalline, serpentine (rare), sheared quartz ± selvages, trachyte (undifferentiated).

2011.2 (ZG34: **AM115**)

Carbonates = 40% wt. Siliclastics = 60% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.15 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: andesite, chert, clinopyroxene, hornblende, monocrystalline quartz, muscovite, plagioclase, sandstone, serpentine (rare), volcanic ash.

2012.11 (ZG35: **AM123**)

Carbonates = 70% wt. Siliclastics = 30% wt. Calcareous matrix (Y / N) Y. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: chert, clinopyroxene, epidote, ferruginous alteration, micrite, olivine basalt, plagioclase, serpentine (rare), soil carbonate.

2012.13 (ZG36: **AM118**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.25 mm: Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: acid igneous groundmass, chert, clinopyroxene, epidote, ferruginous alteration, granite, hornblende, micrite, monocrystalline quartz, polycrystalline quartz (equant), polycrystalline quartz (orientated), serpentine (rare), trachyte (undifferentiated), weathered basalt.

2012.14 (ZG37: **AM120**)

Carbonates = 60% wt. Siliclastics = 40% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M–H. Temper = sand tempered. Inclusions: basalt, chert, chlorite (fired), clinopyroxene, ferruginous alteration, granite, hornblende, micrite, monocrystalline quartz, myrmekite, orthoclase, polycrystalline quartz, trachyte (undifferentiated).

2012.20 (ZG38: AM133)

Carbonates = 10% wt. Siliclastics = 90% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: biosparite, chert, chlorite (fired), clinopyroxene, foraminifera granite, micrite, polycrystalline quartz, sheared quartz ± selvages, trachyte (undifferentiated), weathered basalt.

2039.11 (ZG39: **AM164**)

Carbonates = 10% wt: Siliclastics = 90% wt: Calcareous matrix (Y / N) N, silty. Mean grain size =0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: andesite, chert, chlorite, clinopyroxene, dacite, ferruginous alteration, granite, micrite, monocrystalline quartz, orthoclase, plagioclase, polycrystalline quartz mosaic, serpentine, trachyte (undifferentiated), weathered basalt.

7003.4 (ZG40: not catalogued, combed wavy band)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N). Mean grain size = 0.7 mm. Inclusions matrix (high / medium / low) = M. Temper: possible temper. Inclusions: basalt, chert, clinopyroxene, ferruginous alteration, foraminifera, serpentine (common), trachyte (undifferentiated), weathered basalt.

2039.25 (ZG41: **AM171**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.25 mm. Inclusions matrix (high / medium / low) = M: Temper: no. Inclusions: biosparite, chert, clinopyroxene, dacite, epidote, foraminifera, granite, granodiorite, gypsum, hornblende, plagioclase, serpentine (single), sheared quartz ± selvages.

2260.1 (ZG42: **AM219**)

Carbonates = 15% wt. Siliclastics = 85% wt. Calcareous matrix (Y / N) Y, silty. Mean grain size =0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: acid igneous groundmass, colorless amphibole, clinopyroxene, foraminifera, hornblende, orthoclase, plagioclase, sheared quartz + / selvages, trachyte (undifferentiated).

2080.16 (ZG43: **AM183**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) Y. very high silt content. Mean grain size = 0.25 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: chert, clinopyroxene, epidote, granodiorite, hornblende, micrite, muscovite, orthoclase, plagioclase.

2086.1 (ZG44: **AM202**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: chert, colorless amphibole, clinopyroxene, epidote, fibrous brown amphibole, foraminifera, plagioclase, micrite, polycrystalline quartz, trachyte (undifferentiated).

2039 (ZG45: **AM158**)

Carbonates = 10% wt. Siliclastics = 90% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: biotite, chert, clinopyroxene, epidote, ferruginous alteration, foraminifera, hornblende, micrite, monocrystalline quartz, plagioclase (distinctive euhedral), polycrystalline quartz, serpentine (rare), sheared quartz ± selvages.

2039.21 (ZG46: **AM161**)

Carbonates = 40% wt. Siliclastics = 60% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: chert, clinopyroxene, epidote, garnet, foraminifera, hornblende, monocrystalline quartz, polycrystalline quartz, serpentine, sheared quartz ± selvages, weathered basalt.

2080.12 (ZG47: **AM186**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.75 mm. Inclusions matrix (high / medium / low) = M. Temper: yes. Inclusions: biosparite, basalt, chert, clinopyroxene, epidote, foraminifera, monocrystalline quartz, olivine (rare), orthoclase, plagioclase, serpentine, sheared quartz + / selvages, trachyte (undifferentiated).

2080.13 (ZG48: **AM187**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: yes. Inclusions: andesite, arkose, basalt, chert, clinopyroxene, epidote, foraminifera, granite, monocrystalline quartz, orthoclase, plagioclase, polycrystalline quartz (equant), polycrystalline quartz (orientated), tuff, weathered basalt.

2080.14 (ZG49: **AM185**)

Carbonates = 60% wt. Siliclastics = 40% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: yes. Inclusions: biotite, clinopyroxene, epidote, monocrystalline quartz, olivine (rare, altered), plagioclase, serpentine, tuff.

7062.4 (ZG50: painted jug fragment)

Carbonates = 50% wt. Siliclastics = 50% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.7 mm. Inclusions matrix (high / medium / low) = H. Temper: yes. Inclusions: arkose, chert, clinopyroxene, diorite, epidote, granite, monocrystalline quartz, plagioclase, polycrystalline quartz, serpentine, trachyte (undifferentiated), tuff (single grain).

2010.6 (ZG51)

Carbonates = 70% wt. Siliclastics = 30% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: basalt, clinopyroxene, epidote, foraminifera, garnet, granite, micrite, sheared quartz ± selvages.

2080.4 (ZG52: **AM194**)

Carbonates = 80% wt. Siliclastics = 20% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.8 mm. Inclusions matrix (high / medium / low) = L–M. Temper: possible? Inclusions: basalt, basaltic glass, chert, clinopyroxene, foraminifera, monocrystalline quartz, micrite, muscovite, orthoclase, sheared quartz ± selvages, vein quartz.

2154.1 (ZG53: mortarium)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.6 mm. Inclusions matrix (high / medium / low) = M. Temper: yes. Inclusions: chert, clay pellets, clinopyroxene, ferruginous alteration, garnet, hornblende, monocrystalline quartz, orthoclase, plagioclase, sheared quartz ± selvages.

5034.1 (ZG54: **AM264**)

Carbonates = 70% wt. Siliclastics = 30% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.2 mm. Inclusions matrix (high / medium / low) = M. Temper: possible?: Inclusions: andesite, basalt, clinopyroxene, hornblende, monocrystalline quartz, orthoclase, plagioclase, rhyolite.

7026.1 (ZG55: **AM295**)

Carbonates = 80% wt. Siliclastics = 20% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.2 mm. Inclusions matrix (high / medium / low) = M (silty). Temper: no. Inclusions: basalt, biotite, chert, colorless amphibole, clinopyroxene, ferruginous alteration, foraminifera, monocrystalline quartz, psammite, quartz-mica schist, serpentine, sheared quartz ± selvages.

7036.1 (ZG56: **AM296 / 303**)

Carbonates = 80% wt. Siliclastics = 20% wt. Calcareous matrix (Y / N). Mean grain size = 0.2 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions andesite, basalt (rare), chert, colorless amphibole, clinopyroxene, epidote, ferruginous alteration, foraminifera, granodiorite, granodiorite, hornblende, micrite, plagioclase, polycrystalline quartz, psammite, rhyolite, serpentine, sheared quartz ± selvages.

12012.59 (ZG57: impressed-decoration jug)

Carbonates = 60% wt. Siliclastics = 40% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = M. Temper: possible. Inclusions: basalt, chert, clinopyroxene, foraminifera, orthoclase, micrite, plagioclase (zoned euhedra), rhyolite, trachyte (undifferentiated).

7006.14 (ZG58: **AM287**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.1 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: basalt, biosparite, chert, clinopyroxene, epidote, foraminifera, ferruginous alteration, hornblende, monocrystalline quartz, muscovite, plagioclase, trachyte (undifferentiated).

7007.2 (ZG59: **AM77**)

Carbonates = 40% wt. Siliclastics = 60% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: andesite, chert, clinopyroxene, hornblende, micrite, plagioclase, vein quartz, weathered basalt.

15095.4 (ZG60: **AM25**)

Carbonates = 5% wt. Siliclastics = 95% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.25 mm. Inclusions matrix (high / medium / low) = L. Temper: no. Inclusions: chert, colorless amphibole, clinopyroxene, hornblende, monocrystalline quartz, orthoclase, plagioclase.

15095.9 (ZG61: **AM29**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.2 mm. Inclusions matrix (high / medium / low) = L. Temper: no. Inclusions clinopyroxene, ferruginous alteration, granodiorite, foraminifera, hornblende, micrite, monocrystalline quartz, orthoclase, polycrystalline quartz, weathered basalt.

15095.11 (ZG62: **AM46**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.15 mm. Inclusions matrix (high / medium / low) = L. Temper: no. Inclusions: chert, plagioclase, foraminifera, granite, micrite, rhyolite, weathered basalt, clinopyroxene, muscovite, olivine (single observation).

2278.1 (ZG63: **AM223**)

Carbonates = 15% wt. Siliclastics = 85% wt. Calcareous matrix (Y / N) N, very silty. Mean grain size = < 0.1 mm. Inclusions matrix (high / medium / low) = VH. Temper: no. Inclusions: clinopyroxene, monocrystalline quartz, micrite, muscovite, sheared quartz + / selvages, surface / soil carbonate (abundant), vein quartz.

2158.1 (ZG64: **AM217**)

Carbonates = 20% wt. Siliclastics = 80% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: aegerine-augite (single), chert, clinopyroxene, plagioclase, polycrystalline quartz, potassium feldspar, soil carbonate.

2011.1 (ZG65: **AM116**)

Carbonates = 0% wt. Siliclastics = 100% wt. Calcareous matrix (Y / N) N. Mean grain size = 1 mm. Inclusions matrix (high / medium / low) = L (silty). Temper: yes. Inclusions: clinopyroxene, epidote, granodiorite, hornblende, orthoclase, psammite, rhyolite, sheared quartz ± selvages.

7007.1 (ZG66: **AM88**)

Carbonates = 15% wt. Siliclastics = 85% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M-H. Temper: no. Inclusions: basalt, biosparite, clinopyroxene, epidote, ferruginous alteration, monocrystalline quartz, muscovite, plagioclase, polycrystalline quartz, serpentine, sheared quartz + / -selvages, surface / soil carbonate, trachyte (undifferentiated), vein quartz.

(ZG67 omitted)

Tile fragments (ZG68)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: yes. Inclusions: basalt, chert, clinopyroxene, dacite, foraminifera, granite, granodiorite, micrite, monocrystalline quartz, plagioclase, rhyolite, serpentine (trace), trachyte undifferentiated, vein quartz.

12011.44 (ZG69: **AM455**)

Carbonates = 40% wt. Siliclastics = 60% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: yes. Inclusions: basalt, chert, colorless amphibole, clinopyroxene, foraminifera, granite, granodiorite, hornblende, micrite, orthoclase, polycrystalline quartz, serpentine, sheared quartz ± selvages, vein quartz.

2012.17 (ZG70: **AM143**)

Carbonates = 50% wt. Siliclastics = 50% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: chert, clinopyroxene, hornblende, monocrystalline quartz, plagioclase, sheared quartz ± selvages, vein quartz.

7006.13 (ZG71: **AM292**)

Carbonates = 50% wt. Siliclastics = 50% wt. Calcareous matrix (Y / N) N, silty / fine sand. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: biosparite, chert, colorless amphibole, clinopyroxene, ferruginous alteration, micrite, plagioclase, serpentine, sheared quartz ± selvages, surface carbonate.

7060.8 (ZG72: **AM327**)

Carbonates = 65% wt. Siliclastics = 35% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.4 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: basalt, chert, colorless amphibole, clinopyroxene, ferruginous alteration, foraminifera, micrite, monocrystalline quartz, orthoclase.

7060.8 (ZG73: **AM327**)

Carbonates = 50% wt. Siliclastics = 50% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = M. Inclusions: basalt (rare), biosparite, chert, chromite (rare), colorless amphibole, clinopyroxene (rare), granodiorite, hornblende, monocrystalline quartz, orthoclase, surface carbonate.

7060.9 (ZG74: **AM328**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = L. Temper: no. Inclusions: basalt (>90% all inclusions), chert (rare), clinopyroxene, ferruginous alteration, monocrystalline quartz, plagioclase, serpentine (rare).

12002.13 (ZG75: **AM374**)

Carbonates = 50% wt. Siliclastics = 50% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.3 mm. Inclusions matrix (high / medium / low) = M-H. Temper: no. Inclusions: basalt, chert (rare), colorless amphibole, clinopyroxene, ferruginous alteration, hornblende, monocrystalline quartz, orthoclase, plagioclase, polycrystalline quartz, serpentine (after clinopyroxene), surface carbonate, vein quartz.

12011.24 (ZG76: **AM463**)

Carbonates = 5% wt. Siliclastics = 95% wt. Calcareous matrix (Y / N) N. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: basalt (>95%), clinopyroxene, epidote, ferruginous alteration, granite, monocrystalline quartz, orthoclase, plagioclase, serpentine (after clinopyroxene), weathered basalt.

12011.24 (ZG77: **AM463**)

Carbonates = 70% wt. Siliclastics = 30% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.2 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: biosparite, chert, colorless amphibole, clinopyroxene, foraminifera (rare, derived), micrite, monocrystalline quartz, plagioclase, surface carbonate.

12011.26 (ZG78: **AM465**)

Carbonates = 60% wt. Siliclastics = 40% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.6 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: andesite, chert, clinopyroxene, ferruginous alteration, granite, granodiorite, hornblende, micrite, monocrystalline quartz, orthoclase, plagioclase, soil carbonate, weathered basalt.

12011.41 (ZG79: **AM480**)

Carbonates = 30% wt. Siliclastics = 70% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: biotite, chert, clinopyroxene, dacite, epidote, foraminifera, hornblende, micrite, plagioclase, polycrystalline quartz, rhyolite, sheared quartz ± selvages, weathered basalt.

12011.52 (ZG80: **AM462**)

Carbonates = 70% wt. Siliclastics = 30% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper: no. Inclusions: chert, chlorite, colorless amphibole, clinopyroxene, hornblende, micrite, monocrystalline quartz, orthoclase, serpentine, surface carbonate, vein quartz, weathered basalt.

12012.9 (ZG81: **AM549**)

Carbonates = 60% wt. Siliclastics = 40% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = H. Temper: no. Inclusions: clinopyroxene, epidote, ferruginous alteration, garnet, micrite, monocrystalline quartz, muscovite, orthoclase, plagioclase (zoned euhedra), sheared quartz + / selvages.

12012.10 (ZG82: **AM550**)

Carbonates = 80% wt. Siliclastics = 20% wt. Calcareous matrix (Y / N) Y, overfired pale green. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M. Temper no. Inclusions: basalt (rare), clinopyroxene (rare), dacite, granite (graphic, single observation), hornblende, micrite, orthoclase, plagioclase, polycrystalline quartz mosaic, serpentine (rare).

12012.12 (ZG83: **AM551**)

Carbonates = 70% wt. Siliclastics = 30% wt. Calcareous matrix (Y / N) Y. Mean grain size = 0.5 mm. Inclusions matrix (high / medium / low) = M-H. Temper: no. Inclusions: basalt (rare), chert, clinopyroxene, granite (graphic type, single observation), micrite, monocrystalline quartz, sheared quartz ± selvages.

NOTES

1. In addition to the 56 ceramic samples, a reference sample of sand taken from the Euphrates at Birecik was also submitted for analysis. Thin-section analysis of the sand sample was supplemented by scanning electron microscopy (SEM).
2. See table 3 in chapter 2, this volume.
3. See table 3 in chapter 2, this volume.